Sacramento PEV Collaborative

July 19, 2022

About the Vehicle Grid Integration Council

VGIC
VEHICLE-GRID INTEGRATION COUNCIL

Vehicle Grid Integration Council (VGIC) is a national 501(c)(6) membership-based trade association committed to advancing the role of electric vehicles and vehicle-grid integration through policy development, education, outreach, and research.

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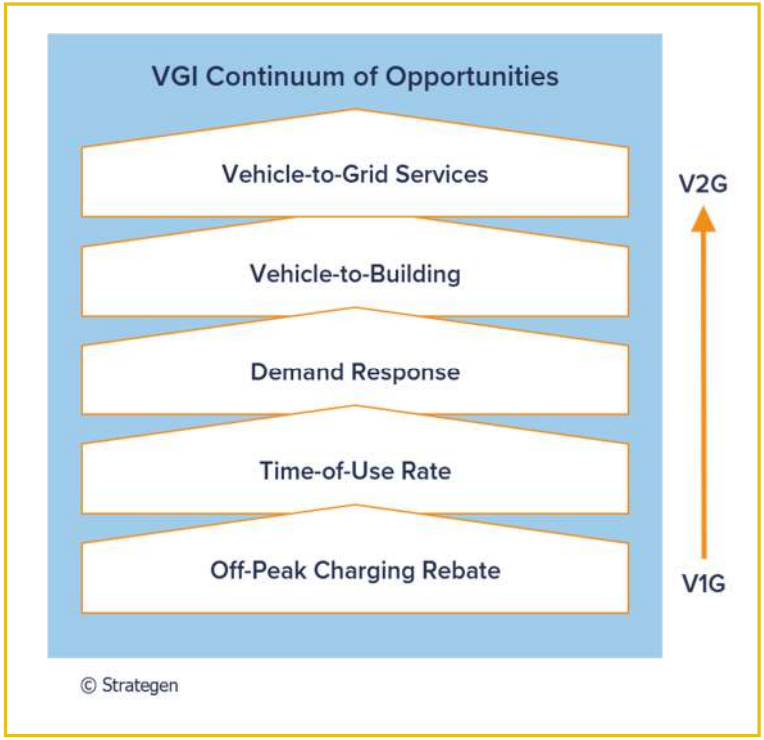
What is vehicle-grid integration (VGI)?

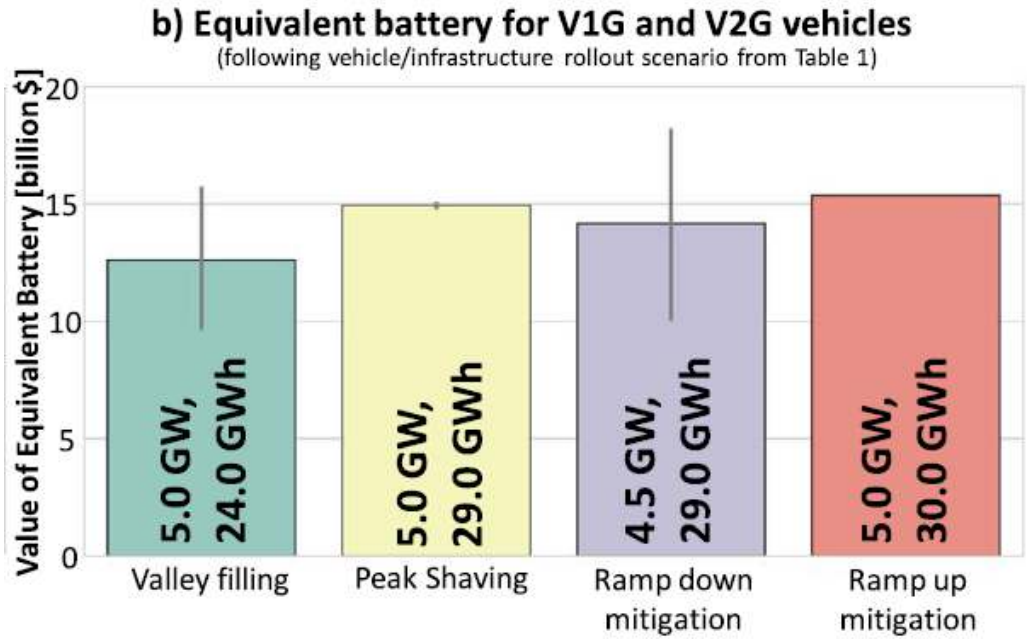
- VGI encompasses the suite of ways EVs can provide services to the grid and be compensated for those services
  - **V1G:** one-direction, managed charging
  - **V2B/V2H:** vehicle used to power a building or home
  - **V2G:** bidirectional charging/discharging for grid services
  - **Station Demand Management**: minimize cost/time for utility infrastructure upgrades
  - **Integrated DERs**: co-located solar, storage, etc.



Electricity grid perspective: EVs on the road today (or coming soon) represent significant energy storage capacity

- In 2021, grid-tied battery storage (large scale) in the US totaled approximately 5.4 GWh.
- For comparison, there is ~138 GWh in battery capacity within the ~2.3 million EVs sold to date in the US (assumes average battery capacity of 60 kWh).

- California is on pace to reach its goal of >1.5 million ZEVs by 2025.
- This could equate to 5 GW and 30 GWh of battery storage capacity for certain grid services.



Why VGI Now?

1. Accelerate Transportation Electrification
2. Support Decarbonizing the Power Sector
3. Increase Affordability of Electricity
4. Improve Grid Resiliency
5. Foster Economic Activity

VGI tools that can add value for fleets today

	Automated Load Management	Demand Response	Managed Charging
			
Benefits:	Reduced charger and interconnection costs, accelerate deployment timeline	New revenue streams from vehicles when parked	Reduced spend on fueling costs/power bill via: • Time of use rates • Off-peak charging rebates • Demand charge management

VGI tools that can add value for facilities today

	Vehicle-to-Building	Backup Power
		
Benefits:	Facility managers lower building energy bill by utilizing parked EVs to power the building during peak demand	Provides backup for critical facility power needs

VGI programs on the rise:

There are >150 active VGI Projects/Programs around the world: https://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442469438

California

- Adopted framework for investor-owned utilities to implement VGI strategies over next 10 years
- Codified rules for V2G interconnection
- Authorized $35 million in funding for VGI Pilots, and $20 million for V2B backup power
- Approved a novel EV aggregation program which pays $2/kWh for V1G/V2G during extreme load events (Emergency Load Reduction Program)
- Nation's first V2G Export Tariff in PG&E's Commercial Dynamic EV Rate (Pending Regulatory Approval)

New York

- Managed charging pilots since 2018
- Mass-market managed charging programs approved July 2022
- Hourly pricing and other rate designs being considered as an alternative to traditional demand-based rates for commercial EV charging

Colorado

- V2G chargers can interconnect to the grid
- Charging Perks OVGIP Pilot with BMW, Ford, GM, Honda
- Fermata and Alliance Center commercial V2B deployment
- Utility research funding for EVs include VGI pilots

Massachusetts

- VGI-capable (both V1G and V2G) chargers may claim Clean Peak Energy Certificates
- Managed charging pilots and EV demand response programs since 2019

VGI fleet pilots and projects around the country

Colorado	Illinois	Virginia	Missouri	California
				
Reducing energy costs for the Recreation Center in Boulder using V2B technology Utilizes city EV fleet to manage building demand charges Led by Fermata Energy using Nissan Leaf EVs	**Equipping school buses with V2B to save money for public school districts** Led by Nuvve and Blue Bird	**Deploying 50 electric buses for Virginia school districts to help them replace diesel buses with electric models equipped with V2G** Can be purchased at sale price as diesel models Dominion will offset the incremental costs as well as the costs of charging infrastructure.	**Nation's largest electric bus fleet uses charging management system to deliver charging at the lowest cost** Led by St. Louis Metro, The Mobility House, and New Flyer Industries 20 150 kW and three 450 kW chargers totaling 4.36 MW	**Power Your Drive pilot supports commercial customers and fleets through charging installation and a dynamic VGI rate** Led by SDG&E 3,000+ charge ports at commercial charging sites Offers a dynamic rate minimize charging costs

VGI Opportunities under Bipartisan Infrastructure Law (BIL)

Application	Potential Funding Source	Priority VGI Opportunities			
		Managed Charging (V1G)	V2X	Station Demand Management	Integration of DERs (e.g., solar, storage)
Corridor Chargers	NEVI Program ($5 billion)				✓
Non-corridor Public Chargers	• Community Charging Grant Program ($2.5 billion); • NEVI (only after corridors are built out)	✓	✓	✓	✓
Electric School Buses	Clean School Bus Program ($5 billion)	✓	✓	✓	✓
All	Smart Grid Program ($3 billion)	✓	✓	✓	✓

Defining service connection and interconnection

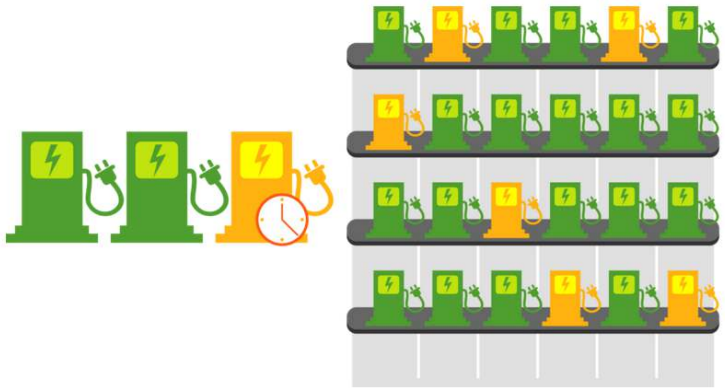
Service Connection New or Upgraded Load	**Interconnection** New or Upgraded Generation
Unidirectional EVSE & Bidirectional EVSE Connecting in Load-Only Mode:  *Bidirectional EVSE Used Only for Backup Power:* 	*Bidirectional EVSE Connecting for Vehicle-to-Building (discharge < site load):*  *Bidirectional EVSE Connecting for Vehicle-to-Grid (discharge > site load):* 

Accelerating service connection with automated load management

- New utility infrastructure can delay service connection and lead to higher costs for EVSE site hosts
- Automated Load Management (ALM) solutions can facilitate:
  - Operation of EVSE before the utility completes necessary infrastructure upgrades (e.g., at lower power)
  - Avoiding infrastructure upgrades altogether
  - Technologies that support other use cases (e.g., battery backup for EVSE, load management during system peak)

Example automated load management solutions

Software-Based ALM (workplace charging, multi-family homes)



1. Instead of each station operating at full power all the time, **stations are controlled individually** based on charging demand.
2. This allows **more charging stations** to be installed while only using a fraction of the aggregate power traditionally required.
3. Businesses shave as much as **60% off** the cost of electrical system upgrades and peak demand charges.

Source: PowerFlex / EDF Renewables

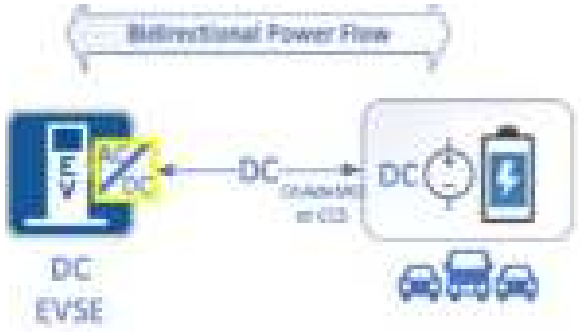
Integrated or Co-Located Energy Storage (public DC fast chargers, fleet depots)

Source: FreeWire Technologies, Inc.

Source: Veloce Energy

Defining Vehicle-to-Everything bidirectional charging systems

V2X DC:
(Stationary inverter in charger)



- EVSE certified to UL 1741
- Some utilities may require UL 1741 SA and SB

V2X AC:
(Inverter functions onboard vehicle)

- EVSE certified to UL 1741 SC (in development)
- EV certified to SAE J3072 (completed)
- SunSpec IEEE 2030.5 / V2G AC Profile (completed)

Common V2X bidirectional charging system configurations

Service Connection:	**A. Load-Only Mode**	**B. Islanded (for backup)**
		
	No generator interconnection and little-to-no review required	*No generator interconnection and little-to-no review required (e.g., notification-only similar to fossil fuel backup generator)*
Interconnection:	**C. Parallel, Non-Export (discharge < site load)**	**D. Parallel, Export (discharge > site load)**
		
	Can fit within existing non-exporting small generator interconnection frameworks	*Can fit within existing exporting small generator interconnection frameworks*

Next steps

VGIC market development and advocacy efforts continue

- Policy and regulatory engagement in CA, NY, MA, CO, and NC
- Market intelligence updates in over a dozen states
- Interested in joining VGIC? Contact Jayleene West (jwest@vgicouncil.org)

V2X connection/interconnection best practices special project:

- Phase 1 (current)
  - Initial outreach and education to key stakeholders (i.e., utilities, regulators).
- Phase 2 (next 6-12 months)
  - Refine recommendations based on initial feedback
  - Continue outreach and education efforts
  - Scale best practices through strategic partnerships

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Thank You!

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